UCN-... M 3/15/95 3/17

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

3112

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Author(s): Requestor: Steve Wiley

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☒ Other (Specify): To Be Released to ChemRisk, Phase II   14 pp

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Title(s): U   Abstract: NA

DOCUMENT Level C   Category RD

J. Rowan (Signature)   3-6-95 (Date)

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[signature] (Signature)   3/3/95 (Date)

Signature   Date

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R J Fraser   3-10-95

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DIVISION	DEPARTMENT	SECTION	BUILDING	ROOM
Industrial Relations	Medical Department	Industrial Hygiene	Bldg. 9706-2	34

DESCRIPTION OF RECORDS	FROM	THROUGH	CODE NUMBER
Air Analyses, Reports, information, correspondence. Enclosed in box is a list of all folders included in the box. A through L	1953	1957	~~[illegible]~~ Y-12 2090-IH-4

DOE Hold 1324.7

BOX NUMBER 1 OF 5

CLASS OF FILE

RECORD [X] NON-RECORD [ ]

LOCATION IN RECORDS CENTER

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TRANSFER OF RECORDS

APPROVED FOR PUBLIC RELEASE

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Technical Information Office Date

FILTER

Problems - 9212

3112

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Purpose

The purpose of this report is to provide quantitative data on the weight loss of particulate uranium through exhaust ventilation and to determine the field performance of filter media provided at hoods in the uranium machining operations. Filter performance includes the efficiency of dust removel and the reduction in air flow which accompanies dust loading. The former is measured directly through iso-kinetic stack sampling; while the latter is evaluated indirectly through air sampling.

Method

The quantitative determination of suspended matter, which passes with a gas through a flue, is made utilizing special equipment. The volume of gas passing in unit time is measured first and then the weight of the suspensoid carried by a unit volume of gas is determined. Total weight of the material carried by the gas can be calculated for any unit of time.

The volume of gas flowing in a closed conduit is measured with a pitot tube and inclined gage. The concentration of dust in gas is determined using the iso-kinetic sampler shown in Figure 1 . The nozzle and sampling rate are selected to insure that the velocity through the sampler tip is approximately equal to the velocity of gas flowing through the flue so that a representive portion of the suspensoid is obtained. The dust sampled from the gas stream is arrested on a Whatman Paper Thimble which, together with the dust, is dissolved and counted. The rate of air flow through the sampler is checked against a calibrated sharp edge orifice and "U" tube and adjusted with a by-pass valve connected to a positive displacement pump.

In practice the sampler tip is located at least 5 diameters from the nearest down stream obstruction in the piping and maintained at the center line. If the velocity distribution across the pipe section varies considerably, a sample traverse is made in accordance with standard ventilation practice.

Data

Results of samples, including flue losses and exposures, are listed in Table 1 . Testing was done on the ventilation arrangement on Machine No. 417 and involved the new hood designed for the polishing of Part

Collected uranium is analyzed by a standard counting procedure and converted to micrograms in expressing the concentration of material in the sample. Weight rate loss of uranium is shown as milligrams per minute although the suspensoid is sampled over a period of time and the

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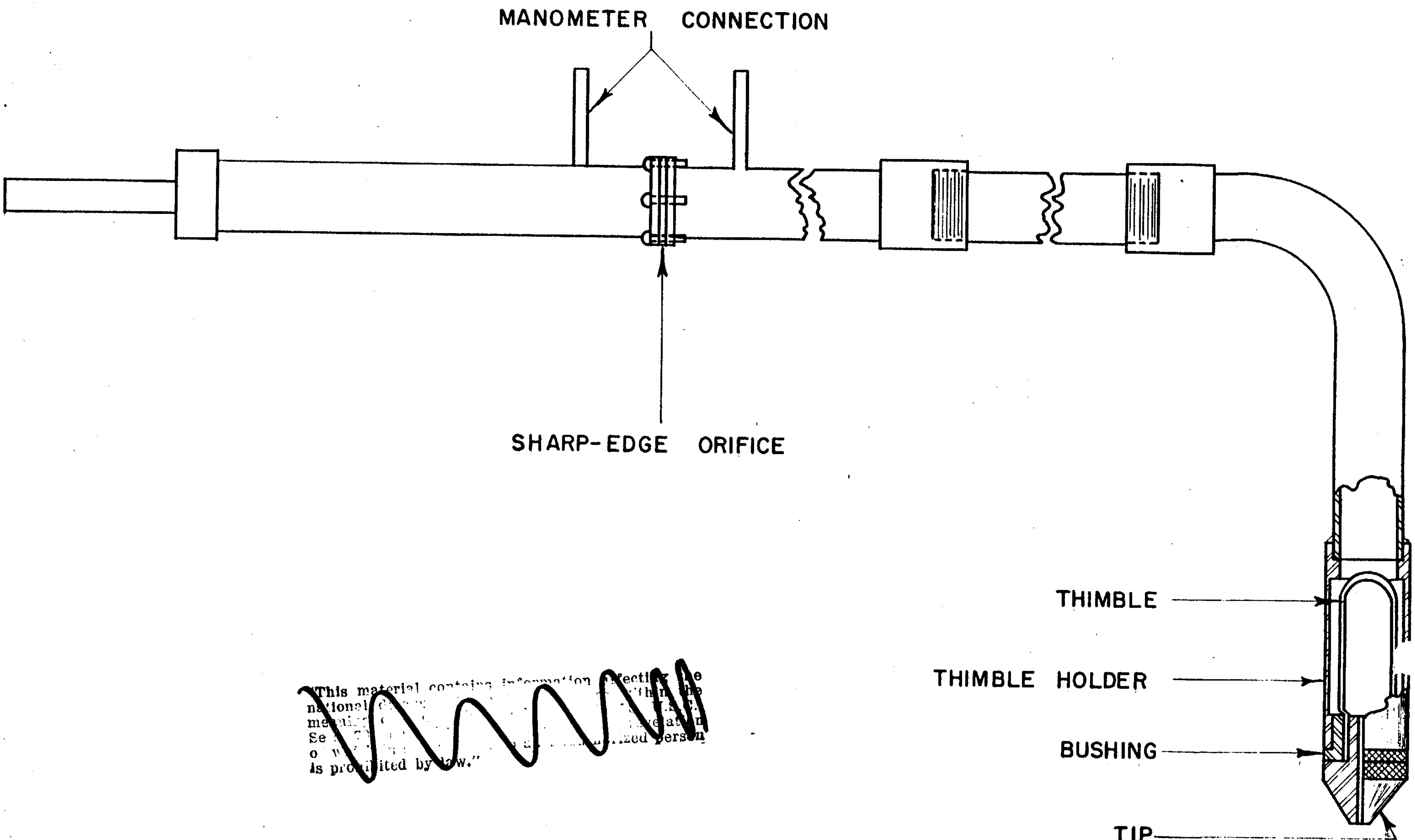

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AIR SAMPLING APPARATUS

Figure 1

result represents an average mass emission rate based on a minute as the unit of time.

The rate of air handled by the hood is obtained from pipe velocity and area calculations and is expressed as cubic feet per minute.

Air data is obtained using conventional equipment and the samples taken at the breathing zone of the machinist while polishing.

<u>Interpretation of Data</u>

The results presented in Table 1 , from samples taken within the six inch ventilation pipe do not give conclusive evidence of filter effectiveness since the scope of the investigation is preliminary. It is thought that the test data should be examined at this time for a decision as to whether, or not, to continue this study.

Selection of a proper filter media cannot be made on the meager information now available. The testing procedure should be directed towards obtaining information which may provide a basis for choosing one type filter in preference to others. Several requirements which should be considered are as follows:

1. A filter with high particle retention for maximum recovery of uranium. Sub microscopic particles are not important from a reclamation standpoint since weight contribution by this size fraction is small although they do contribute importantly to health hazards.

2. Low initial resistance with a minimum build-up accompanying dust loading.

3. Ease of removal of salvagable material from the filter medium.

4. Reuse of filter medium following cleaning.

5. Low replacement cost for disposal type filter or low make-up cost if the medium is reclamable.

6. Low maintenance costs.

7. Central dust collecting system versus unit collectors incorporated in the ventilation hood.

In reviewing several findings in Table 1 on uranium rate loss, the following interpretations are advanced :

1. The inside diameter polishing operation contributes much less dust than outside diameter polishing.

2. The air-borne concentrations (column 8) are well below the M.P.L. of 70 $d/m/M^3$ which indicates effective control although there is a 30% reduction in air flow (column 7) due to the presence of the filter.

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3. The bronze fiber filter bed has low penetration (sample 6, column 6); however, a later test, # 8, shows poor performance following cleaning of the filter. The bronze is hand packed which may give rise to non-uniform flow through the filter bed.

4. Fiberglass filter (AAF Amer-Glass) has poor particle retention as shown by sample # 3 (column 6).

5. The high filtering velocity (745 fpm) for bronze fiber and (690 fpm) for glass fiber, may be responsible for deterioration of the filter bed.

6. Direction of rotation during polishing and the condition of its surface apparently affect the quantity of dust arrested at the hood.

Impingement describes one of the mechanisms responsible for removing particulate suspended matter i.. a gas in passing through a fibrous bed; and its effect is greater for larger particules and with increased velocity of flow. Undoubtedly there is a maximum gas velocity above which any increase in velocity will not effect dust retention. Also, filtration efficiency as well as pressure drop across a fibrous bed is affected by bed depth and packing density. If the investigation continues these variables should be studied to determine the most effective filter suitable for the installation.

Summary and Conclusion

A preliminary study is underway to evaluate filter effectiveness in removing the dust generated in polishing by measuring the rate of uranium passing through the filter. Results of the tests are presented with some explanation of their significance. The present data is limited so definite conclusions cannot be established; however, a decision should be made as to whether or not this work should be continued. It is our opinion that filtration at the source of dust generation is neither practical nor effective for the operations involved in machining normal uranium. An effective filter needs to be developed for this installation which means additional developm-nt and testing.

A central dust cleaning unit may prove advantageous over unit collectors since high recovery of uranium is possible yet maintenance may not be burdensome nor costs too high. It is true that the initial cost of a central unit may be high but continuous replacement of unit collectors over a period of time may prove more costly; furthermore, performnace is more consistent with a central unit since operational variation and maintenance will affect unit filter performance. Also, the handling costs for recovery may be high with individual filters whereas the cleaning of a central unit can be automatic.

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COMPILATION OF TEST DATA

Table 1

Avg. = 90.7 →

4.017600^{6} ~~[illegible]~~ $\frac{mg}{mgm} \times \frac{1\,kg}{10^6\,mg}$

#1	#2	#3	#4	#5	#6	#7	#8	#9
Sample No.	Date	Operation	Filter	Conc. U In Sample µg/M³(1)	Wt. Rate Loss U µg/min.(2)	Rate Air Flow Through Hood cfm.(3)	Air Sample Results d/m/M³(4)	Remarks
1	1-23-52	Polishing o.d.	No filter	3,280	96.7	1040	13.1	Reverse rotation polishing with paper #180 & finer.
2	1-23-52	Polishing i.d.	No filter	830	24.5	1040	1.0	Reverse rotation
3	1-7-52	Polishing o.d.	Fiberglass (AAF Amer-Glas)	17,800	452.	800	7.5	Reverse rotation Clean filter - 1st run.
4	1-7-52	Polishing i.d.	Fiberglass (AAF Amer-Glas)	—	—	900	—	Sample lost.
5	1-7-52	Polishing o.d. & i.d.	Fiberglass (AAF Amer-Glas)	1,320	38.8	760	2.2	3rd run through filter. Normal rotation.
6	1-15-52	Polishing o.d.	Bronze filter 1st run	160	4.0	870	4.7	Normal rotation fine abrasive paper used.
7	1-15-52	Polishing i.d.	Bronze filter 1st run	40	0.88	870	1.0	Normal rotation
8	1-24-52	Polishing o.d.	Bronze Filter	4,320	106.	880	—	Reverse rotation filter in poor condition.
9	1-24-52	Polishing i.d.	Bronze Filter	210	5.3	880	24.2	Reverse rotation filter in poor condition.

(1) µg/M³ - micrograms per cubic meter.
(2) mg/min. - milligrams per minute.
(3) cfm - cubic feet per minute.
(4) d/m/M³ - disintegrations per minute per cubic meter.

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The entire problem may be complicated if filters are installed on ventilated hoods for machining operations involving the use of copious amounts of coolant. It is our opinion that the nonsignificant amounts of reclamable uranium dust generated at these wet operations do not justify the use of filters; however, some tests should be made to determine these quantities.

W. H. Baumann,

C. M. West,
Health Physics Department

WHB:ms

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No 17
.01 18
1C 19

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7-29-72

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0.00

To BILL BAUMANN;

The glass fiber filter #8 was leached twice, made to 100 ml, and 2 10 ml aliquots plated. The average of the two results was 142 c/m with a deviation of less than 3½ %.

A sample of normal uranium counting 284 d/m/10 ml would result in a total amount of uranium in the thimble of 1825 ugm.

D. Ross

TRANSMITTAL FORM

To: Planning & Estimating Dept. (2) W. O. No. 501998

Copies: Messrs. F. F. Gallo, E. Zurcher, E. G. Stevenson, and J. C. Little; and Files (2) Date 6-16-52

Brief Title of Job Dust Collectors

Bldg. No. 9212

Attached Are The Following Listed Items Pertaining To The Above Job:

- [ ] Bill Of Material, Sheets ______ To ______ Inc. Dated ______
- [ ] Advance Material Listing Sheets, Sheets _____ To _____ Inc. Dated ______
- [ ] No Bill Of Material Required
- [ ] No Drawings Required

Drawings: ______

JOB INSTRUCTIONS: Please obtain bids on air filtering equipment in accordance with the attached specifications.

[illegible] VE CONSTITUTES Partial ~~[illegible]~~ ENGINEERING DESIGN FOR THE ABOVE JOB.

ENGINEERING DIVISION

Principal Engineer ______ J. C. Little

SIGNED: J. C. BOWLES

Department Head ______

J. C. Bowles

<u>W. O. 301998</u>

Order two (2) Hersey Reverse-Jet Bag Type Air Filter Units meeting the following specifications.

<u>Capacity</u> - Each filter to be capable of handling one hundred and fifty thousand (150,000) cubic feet per minute of exhaust air at a temperature of 70° F.

<u>Filter Rate</u> - Thirty (30) cfm per square foot of filter area.

<u>Filter Media</u> - The filter units shall use fire-resistant, pressed Dynel felt bags, with resistance, when clean, of approximately 1" H_2O.

<u>Efficiency</u> - The absolute amount of dust passing the filters shall be between 0.002 and 0.00002 grains per cubic foot (independent of inlet loading) based on atmospheric dust.

The units shall be furnished complete and shall include filter housings, dust hoppers equipped with butterfly dampers, catwalks at both upper and lower access doors, steel ladders connecting ground and catwalks, adjustable blow rings, blow ring drive mechanisms, blow ring manifolds, compressor or compressors as required for the operation of the Hersey reverse-jet blow ring units, instruments and controls as required for automatic operation of blow ring units, dust drums (55 gal. each) and intake filters on blow ring compressors.

The units shall be designed to withstand a 16 inch H_2O negative pressure and a wind velocity of 75 mph. The units shall be designed for outdoor installation. The maximum size of the units, excluding catwalks, shall be 30' in height, 12' in width, and approximately 40' in length. The air to be filtered shall enter the units at the top and filtered air shall be discharged on the 12' end of the units. Suitable flanges for duct installation shall be provided at the effluent end of the filters.

Structural steel members shall be provided to support the units a sufficient height above the concrete foundations to allow for installation of butterfly dampers and dust drums. Each hopper shall be provided with an access door approx. 2 ft. square.

Each unit shall be furnished with one (1) extra set of 18" dia. Dynel felt bags.

All electrical equipment shall be designed to operate on 440 volts, 3 phase, 60 cycle A.C. and shall be totally enclosed for outdoor operation.

The units shall be erected under the supervision of an engineer to be furnished by the equipment manufacturer. Included with the manufacturer's proposal shall be the cost of providing an engineer to supervise erection and testing of the two filter units.

JUN 17 1952 M. O. 501998 Cont'd.

Included with the quotation for the above equipment shall be drawings of the proposed filter units, detailed specifications on all component parts, equipment and controls of the filter units, efficiency of Dynal Bags (effluent concentrations with atmospheric dust) and pressure drop across bags and across entire units.

The air filter units shall be as manufactured by one of the following or approved equal.

Pulverizing Machinery Co., Summit, N. J.; Turner and Haws Engineering Co., Inc., Boston, Mass.; and The Day Co., Minneapolis, Minn.

J. C. Little

ef

6-16-52

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO W. H. Baumann
LOCATION 9711-1

DATE May 14, 1952

ANSWERING LETTER DATE

ATTENTION

COPY TO E. G. Struxness
File

SUBJECT

Analysis of the fourteen filter thimbles used in a 9212 ventilation study has been completed. Each thimble was thoroughly leached for 30 minutes with concentrated HNO_3 and the resultant solution made up to 100 ml in a volumetric flask. Duplicate 0.1 ml samples were pipetted into gold dishes, evaporated under heat lamps fused with 300 mg of flux, and read in a fluorophotometer. Agreement of the duplicate samples was very good; in only one case did the deviation from the mean exceed 3%.

Sample No.	Date	Uranium per 0.1 aliquot gms.	Uranium per thimbles ugm.
4	4-17-52	1.7×10^{-7}	170
5	4-17-52	2×10^{-8}	20
6	4-17-52	7.5×10^{-8}	75
7	4-18-52	1.9×10^{-7}	190
8	4-18-52	1.7×10^{-8}	17
9	4-18-52	1×10^{-8}	10
10	4-21-52	2×10^{-8}	20
11	4-21-52	1.5×10^{-8}	15
12	4-22-52	1.5×10^{-8}	15
13	4-23-52	8×10^{-9}	8
14	4-23-52	2×10^{-8}	20
15	4-29-52	1.6×10^{-7}	160
16*	4-30-52	-----------	---
17	5-6-52	5.5×10^{-8}	55

*Sample # 16 contained a very large piece of uranium which would have biased the results by a large factor and seriously contaminated the equipment. No analysis was made although the sample was retained.

Don Ross

Don Ross,
Health Physics Department

OK
File

DR:ms

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO W. A. Baumann
LOCATION 9711-1

DATE April 10, 1952

ANSWERING LETTER DATE

ATTENTION

COPY TO File

SUBJECT Thimble Analysis

The thimbles were analyzed fluorometrically in the following manner:

Thimbles were digested (leached) in concentrated HNO_3 for 15 minutes. The resultant solution quantitatively transferred to 100 ml., Volumetric flasks and filled to the mark. 100d was removed evaporated in a gold dish, fused with a mixed NaF- Na_2CO_3 flux and read in the fluorophotometer. Each answer is the average of duplicated samples:

	Reading	u/100d	u/thimble
Thimble #1	10.8	1×10^{-8} gm	10 ugm
Thimble #2	2.0	2×10^{-9}	2
Thimble #3	485	44×10^{-8}	440

Donald Ross,
Health Physics Department

DR:ms

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INTER-COMPANY CORRESPONDENCE

~~SECURITY INFORMATION~~

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office OAK RIDGE,

TO J. M. Herndon
LOCATION 9706-1A

DATE March 11, 1952

ANSWERING LETTER DATE

ATTENTION

COPY TO W. D. Lavers
J. C. Bowles
N. H. MacKay
J. S. Reece
W. H. Shamhardt
W. H. Baumann ✓
C. M. West

SUBJECT Filter Testing at Machine No. 417, A-Wing, 9212

A preliminary report is enclosed herewith on work done in the A-1 Machine Shop, 9212 Area, to determine the efficiency of collection of fibrous filters on dust generated in polishing. The data compiled in this report is of limited scope and is presented at this time in the expectation that a decision will be forthcoming as to whether or not this study should be continued.

The work started with the hood development and the subsequent installation of a unit filter at Machine No. 417 used for polishing. It is expected that the hood design project will expand to include virtually all machining operations in the A-Wing of 9212. The problem of cleaning the ventilation air exhausted through the hoods and salvaging the collected uranium dust in an efficient and economical manner should be considered more thoroughly to determine the proper kind of filtering arrangement.

The Health Physics Department is particularly anxious to work with other interested groups in hood design insofar as it affects the exposure of a machinist, and in filter selection since we have the essential testing equipment and techniques.

Original signed by E. G. Struxness
E. G. Struxness,
Health Physics Department

EGS:ms

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WCX-80 (3-51)

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Purpose

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The quantitative determination of suspended matter, which passes with a gas through a flue, is made utilizing special equipment. The volume of gas passing in unit time is measured first and then the weight of the suspensoid carried by a unit volume of gas is determined. Total weight of the material carried by the gas can be calculated for any unit of time.

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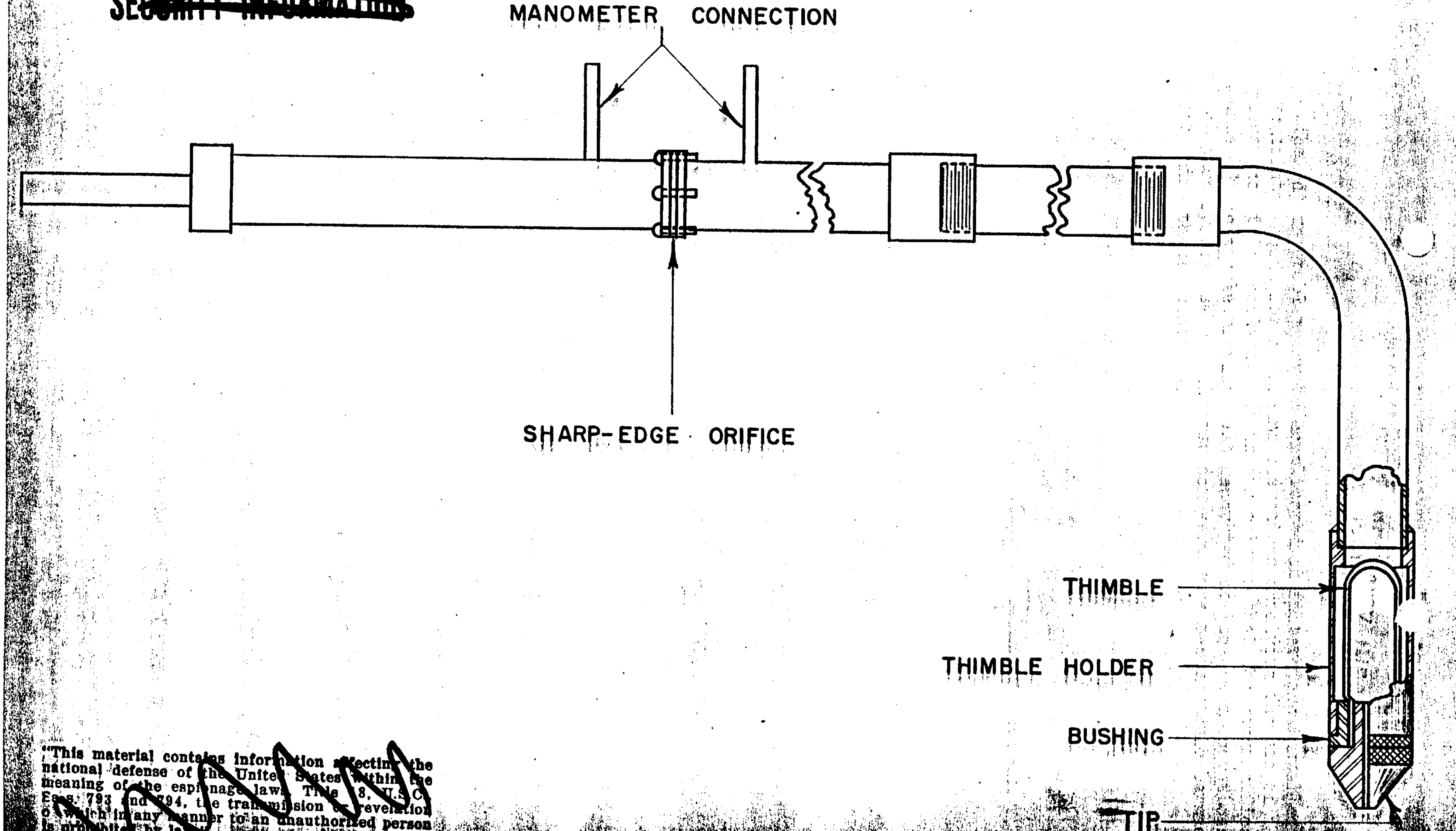

AIR SAMPLING APPARATUS

Fig. 1

result represents an average mass emission rate based on a minute as the unit of time.

The rate of air handled by the hood is obtained from pipe velocity and area calculations and is expressed as cubic feet per minute.

Air data is obtained using conventional equipment and the samples taken at the breathing zone of the machinist while polishing.

Interpretation of Data

The results presented in Table 1, from samples taken within the six inch ventilation pipe do not give conclusive evidence of filter effectiveness since the scope of the investigation is preliminary. It is thought that the test data should be examined at this time for a decision as to whether, or not, to continue this study.

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4. Reuse of filter medium following cleaning.

5. Low replacement cost for disposal type filter or low make-up cost if the medium is reclamable.

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7. Central dust collecting system versus unit collectors incorporated in the ventilation hood.

In reviewing several findings in Table 1 on uranium rate loss, the following interpretations are advanced :

1. The inside diameter polishing operation contributes much less dust than outside diameter polishing.

2. The air-borne concentrations (column 8) are well below the M.P.L. of 70 d/m/M^3 which indicates effective control although there is a 30% reduction in air flow (column 7) due to the presence of the filter.

3. The bronze fiber filter bed has low penetration (sample 6, column 6); however, a later test, # 8, shows poor performance following cleaning of the filter. The bronze is hand packed which may give rise to non-uniform flow through the filter bed.

4. Fiberglass filter (AAF Amer-Glass) has poor particle retention as shown by sample # 3 (column 6).

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Impingement describes one of the mechanisms responsible for removing particulate suspended matter in a gas in passing through a fibrous bed; and its effect is greater for larger particules and with increased velocity of flow. Undoubtedly there is a maximum gas velocity above which any increase in velocity will not effect dust retention. Also, filtration efficiency as well as pressure drop across a fibrous bed is affected by bed depth and packing density. If the investigation continues these variables should be studied to determine the most effective filter suitable for the installation.

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COMPILATION OF TEST DATA

Table 1

#1 Sample No.	#2 Date	#3 Operation	#4 Filter	#5 Conc. U In Sample $\mu g/M^3$ (1)	#6 Wt. Rate Loss U mg/min. (2)	#7 Rate Air Flow Through Hood cfm. (3)	#8 Air Sample Results $d/m/M^3$ (4)	#9 Remarks
1	1-23-52	Polishing o.d.	No filter	3,280	96.7	1040	13.1	Reverse rotation polishing with paper #180 & finer.
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5	1-7-52	Polishing o.d. & i.d.	Fiberglass (AAF Amer-Glas)	1,820	38.8	760	2.2	3rd run through filter. Normal rotation.
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8	1-24-52	Polishing o.d.	Bronze Filter	4,320	106.	880	—	Reverse rotation filter in poor condition.
9	1-24-52	Polishing i.d.	Bronze Filter	210	5.3	880	24.2	Reverse rotation filter in poor condition.

(1) $\mu g/M^3$ - micrograms per cubic meter.
(2) mg/min. - milligrams per minute.
(3) cfm " - cubic feet per minute.
(4) $d/m/M^3$ - disintegrations per minute per cubic meter.

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The entire problem may be complicated if filters are installed on ventilated hoods for machining operations involving the use of copious amounts of coolant. It is our opinion that the nonsignificant amounts of reclamable uranium dust generated at these wet operations do not justify the use of filters; however, some tests should be made to determine these quantities.

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~~"This material contains information affecting the national defense of the United States within the meaning of the espionage laws, Title 18, U.S.C., Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law."~~